Welcome to Germany

Welcome at Potsdam

Part 1

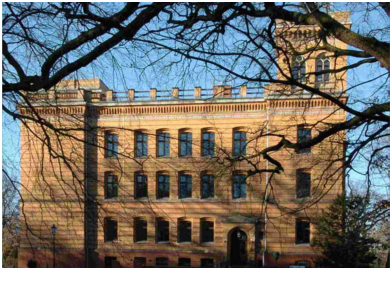
Climate Data & Diagnostic

PIK

RD1

Earth System Analysis

Atmosphere, Ocean, Ice Sheet & Vegetation



RD3

Sustainable Solutions

Global Adaption Strategies, Policy Assessment

Multi-sector Impacts and Climate Extremes

Climate Impacts and Vulnerabilities

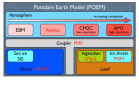
RD2

Complex Networks and Visualization

Transdisciplinary Concepts & Methods

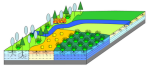
RD4

Models/Tools at compute cluster:



POtsdam Earth Model

Parallel Ice Sheet Model



Lund-Potsdam-Jena managed Land

COSMO-ClimateLimited-areaModelling

Soil and Water Integrated Model

FORESt Ecosystems in a Changing Environment

Outline:

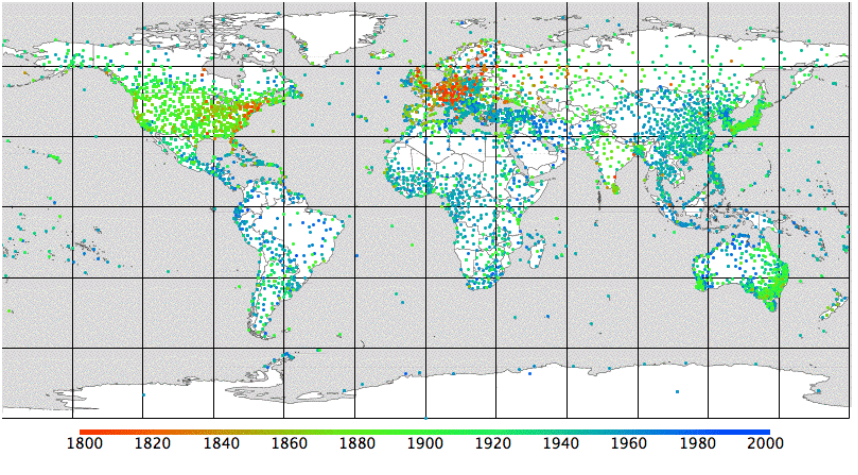
1. Climate Data
    1. from global to national: access ++ costs ++ handling
2. Climate Diagnostic
    1. from global to local: circulation pattern ++ extremes
3. Climate Scenarios
    1. from global to regional: dynamical/statistical ++ access ++ bias correction
4. Weather in Climate Models
    1. objectivation of European circulation pattern
    2. assessment of climate models

Climate Data:

Scale	Dataset		Access	Costs	Usage
global	WATCH	daily	consortium	—	ISI-MIP
	CRU	monthly	consortium	—	Studies
	WDC	monthly	connection	5000 €/yr	Studies
regional	E-OBS	daily	free access	—	Monitoring
national	DWD	hourly/daily	limitted access	250 €/yr	Swim-live downscaling
global	GFS/CFS	3 hourly	free access	—	forecasting

- Data handling:
  - exchange via ftp and wget
  - interactive programming languages: R & Python

Climate Data: global



GCHN Database, as used by CRU and NCDC

PIK

Climate Data: monthly climate data

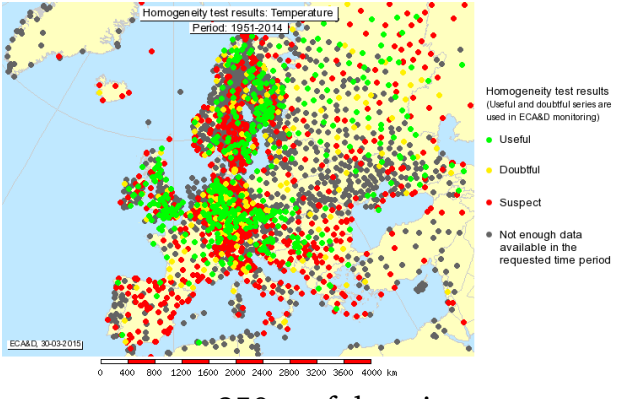
WDC, Obninsk

```
Ethiopia (Part B)( 63300- 63599)
6333120150208055199999902281089199999999999903101015010901
6340220150208367199999902001124105101691194103161008412121
6347120150208865199999902461125199900001017103231016912721

Kenya & Tanzania (United Republic of) & Uganda( 63600- 63979)
6375620150208858199999902401214104100361999902891999992401
6383220150208826199999902341215110100841999902981015912351
6396220150208950199999902261219112100751001102861015111731
6397120150209979110107102731295103100961999903091023712451

Zaire( 64000- 64379)
6421020150209753110101102631277110102411999903171022619999
```

NST(5) + YEAR(4) + MONTH(2) + P0(6:0.1mb) + P(6:0.1mb) + TMEAN(5:0.1°C) + VAP(4:0.1mb) + N(3:>1mm) + R(5:1mm) + ST(4) + TMAX(5:0.1°C) + TMIN(5:0.1°C) + SUN(4:1h)

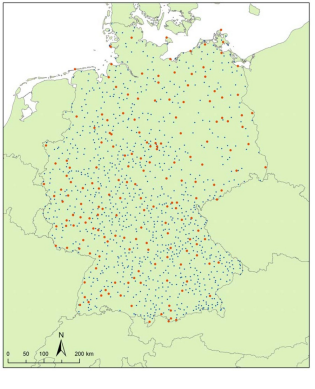
Climate Data: regional to national

Europe (E-OBS, 0.25° x 0.25°)



ca. 250 useful stations

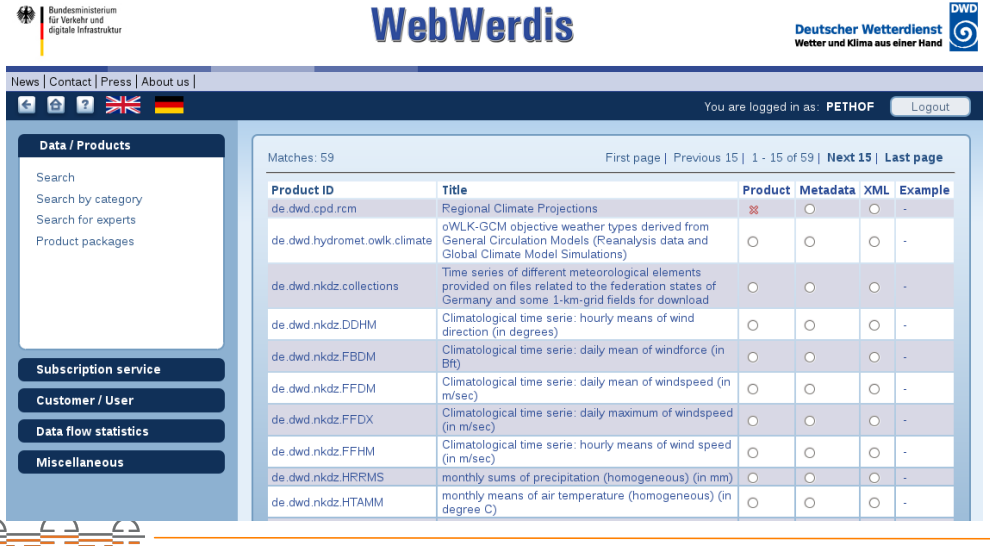
Germany (DWD)



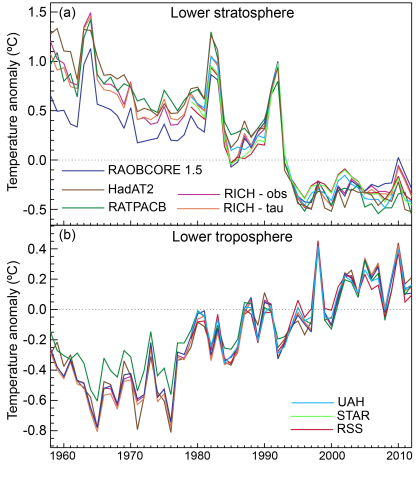
180 & 1038

PIK

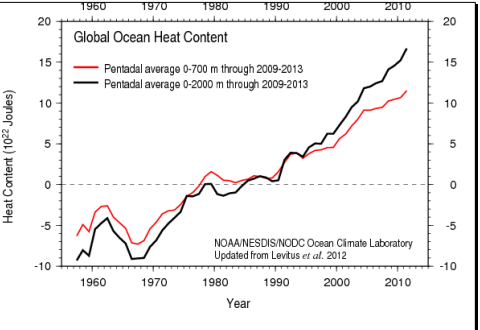
Climate Data: Access



Climate Diagnostic: Temperature (Atmos./Ocean)

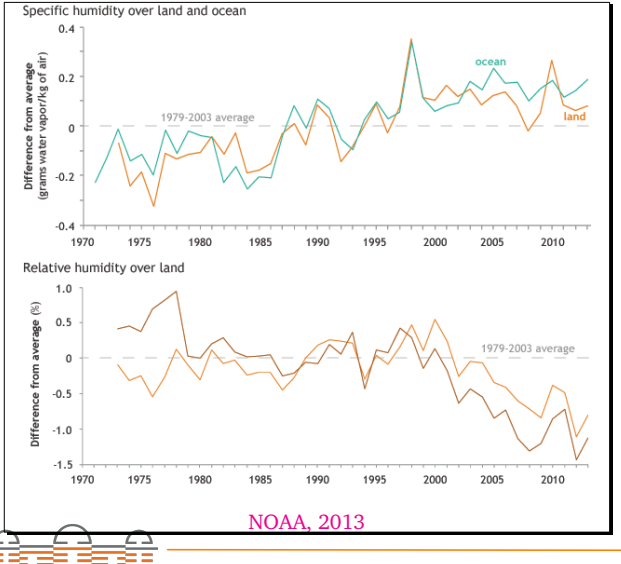


IPCC, 2013



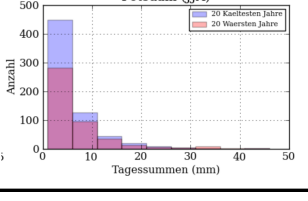
- lower troposphere warming
- lower stratosphere cooling
- ocean heat content: rising

Climate Diagnostic: Humidity (global)

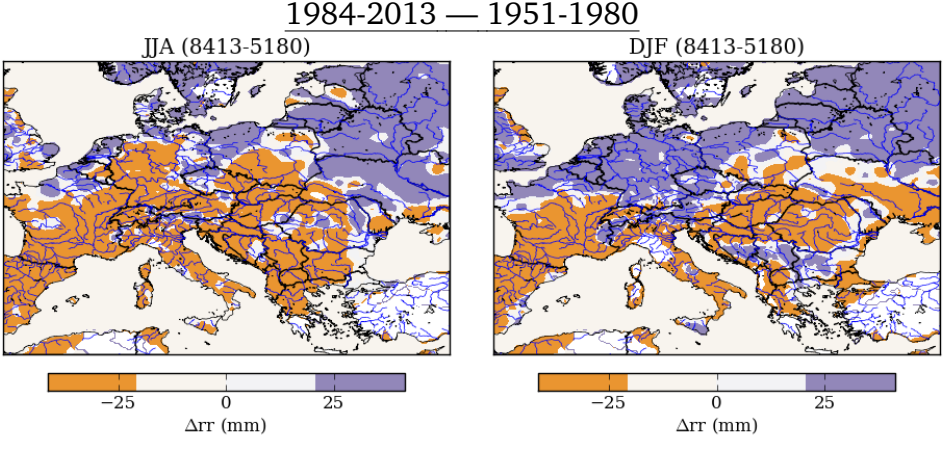


NOAA, 2013

- specific humidity (g/km)
  - rising
  - more wv in atmosphere
- relative humidity (%)
  - falling
  - condensation level rises
- if its rain than more heavy
- shift of the precipitation spectrum

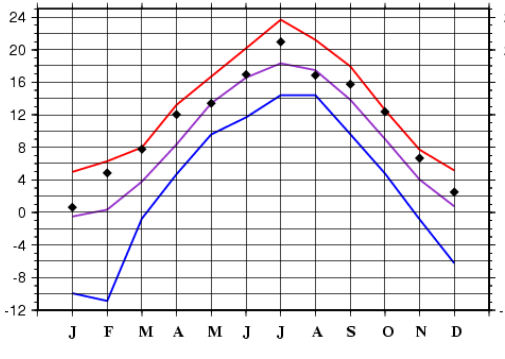


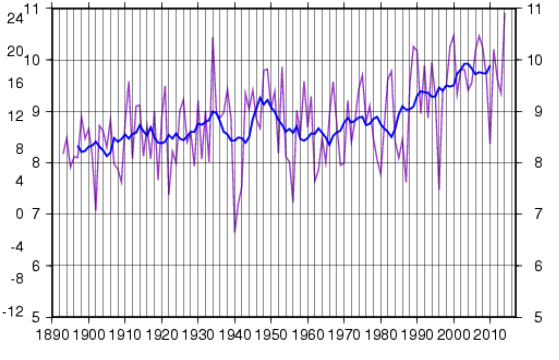
Climate Diagnostic: Precipitation (Europe)



Summer **E-OBS** Winter

Climate Diagnostic: Potsdam

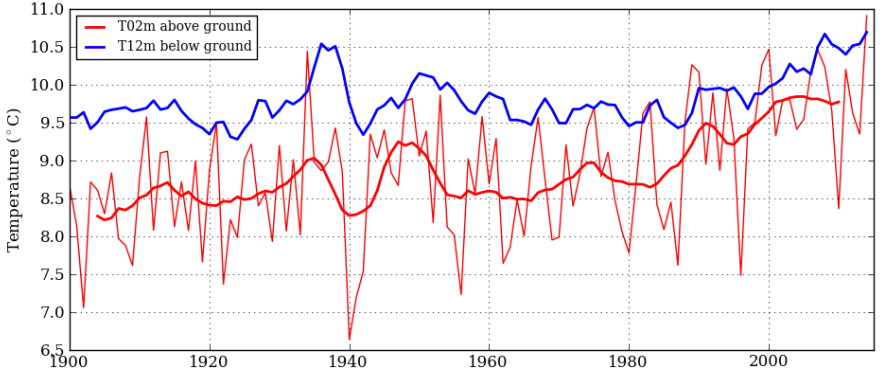




2014: the warmest year on record (10.91°C)
globally, in Europe and in Germany

PIK

Climate Diagnostic: Potsdam



annual mean Temperature

2m-Temperature **and** 12m Temperature below ground

Climate Diagnostic: Potsdam

year Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

show

date	highest daily maximum of air temperature in year
9. 8.1992	39.1 °C
11. 7.1959	38.4 °C
10. 7.1959	38.2 °C
11. 7.2010	38.0 °C
1. 8.1994	37.7 °C

year Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

show

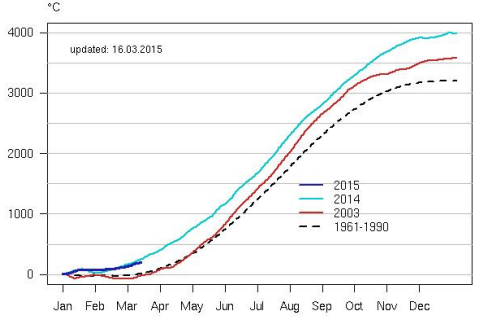
date	lowest daily minimum of air temperature in year
11. 2.1929	-26.8 °C
10. 2.1929	-26.0 °C
19. 1.1893	-25.7 °C
21.12.1969	-24.5 °C
18. 1.1893	-24.3 °C

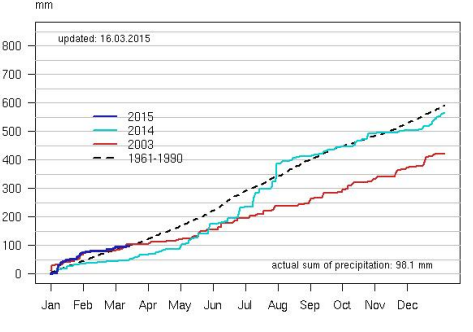
year Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

show

date	highest daily total of precipitation in year
8. 8.1978	105.7 mm
12. 8.2002	83.9 mm
9. 7.1927	83.1 mm
29. 8.1969	79.2 mm
25. 6.1940	69.2 mm

Climate Diagnostic: Potsdam



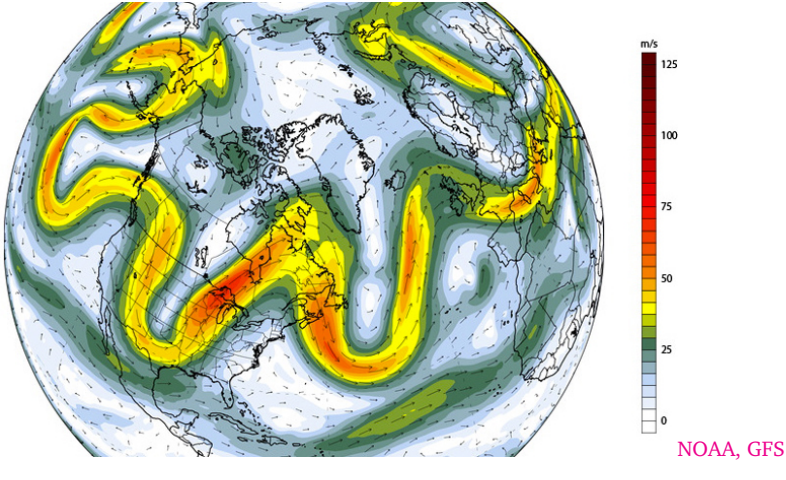


2015: cumulative charts

Temperature (left) and Precipitation (right)

PIK

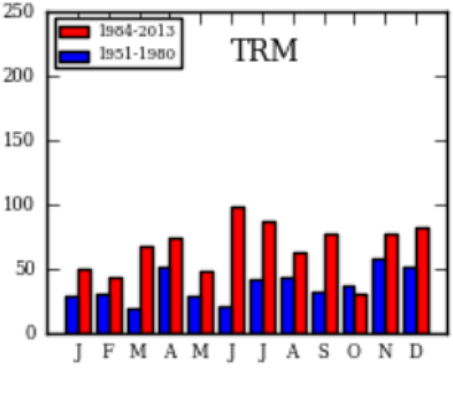
Climate Diagnostic: Jetstream

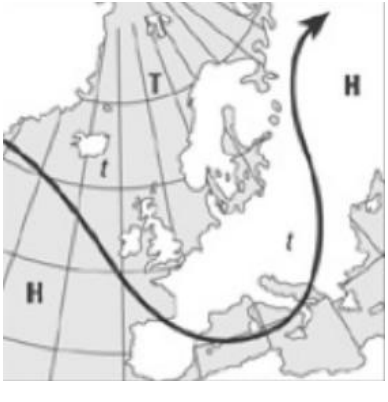


NOAA, GFS

weather driver

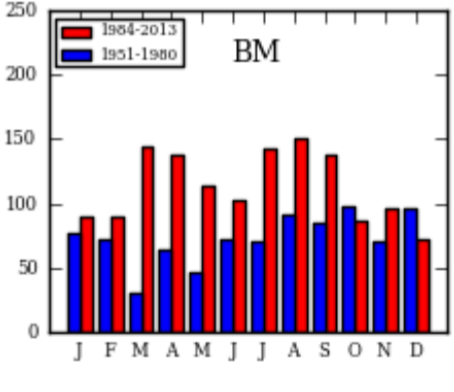
Climate Diagnostic: Weather Situations

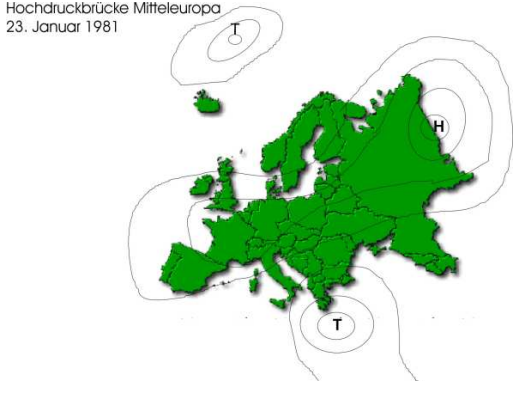




”Trough over Central Europe”
increasing

Climate Diagnostic: Weather Situations



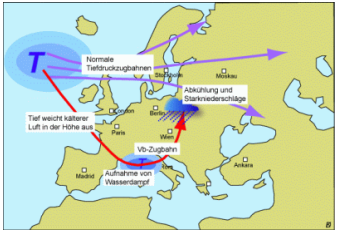


”High Bridge over Central Europe”
increasing

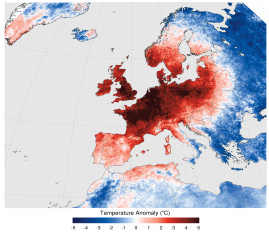
PIK

Climate Diagnostic: Extreme Weather Events

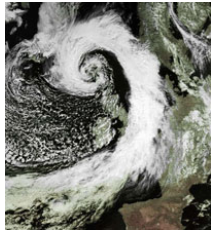
Floods



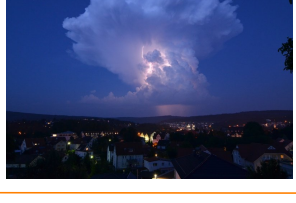
Heatwaves



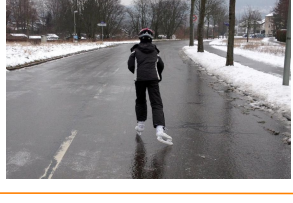
Storms



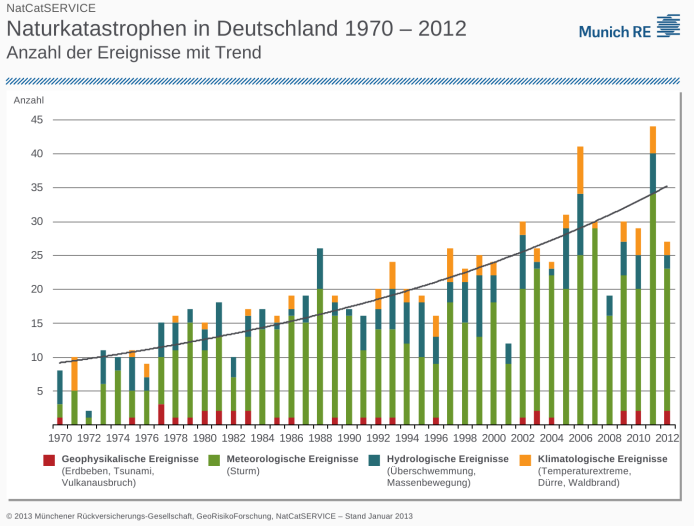
Thunderstorms



Black Ice

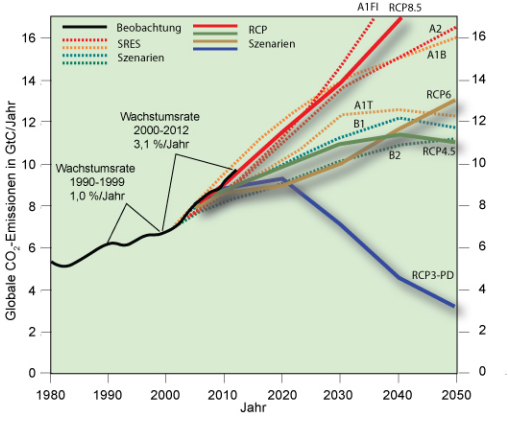


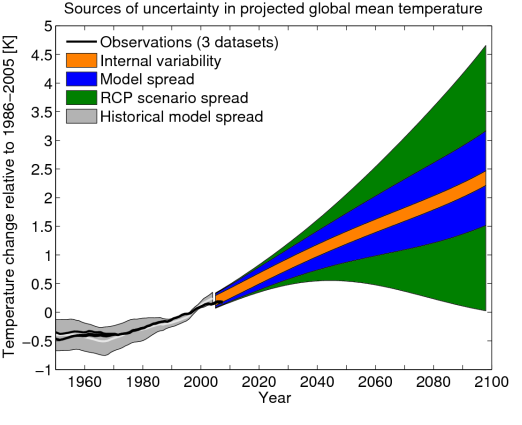
Climate Diagnostic: Natural Disasters



Munich RE, 2013

Climate Scenarios: Emissions & Temperature





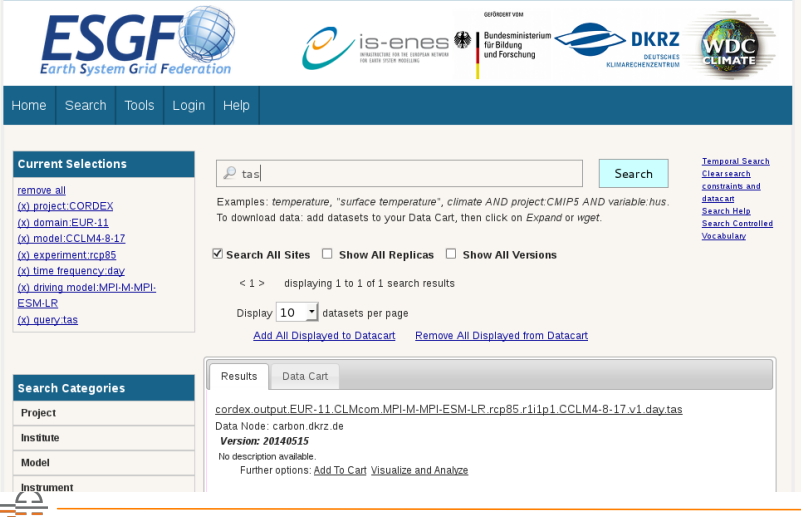
IPCC, 2013

RCP 8.5 (business as usual scenario): $4K \pm 0.5$

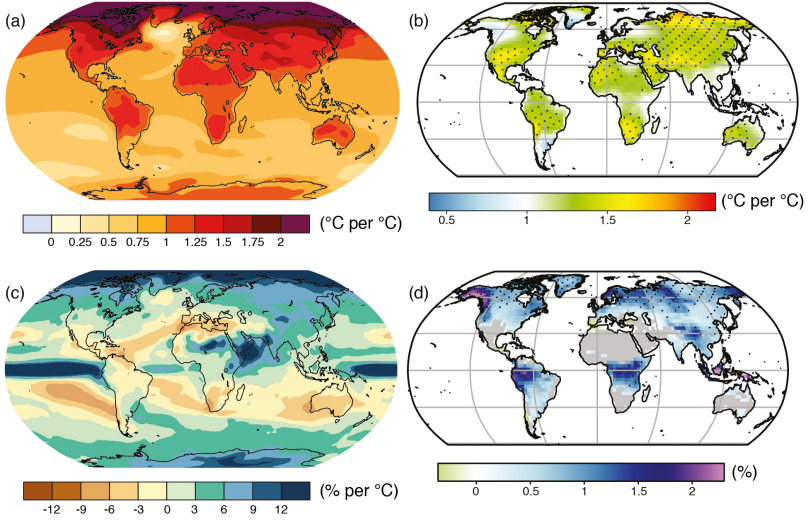
the most likely one

PIK

Climate Scenarios: ESGF



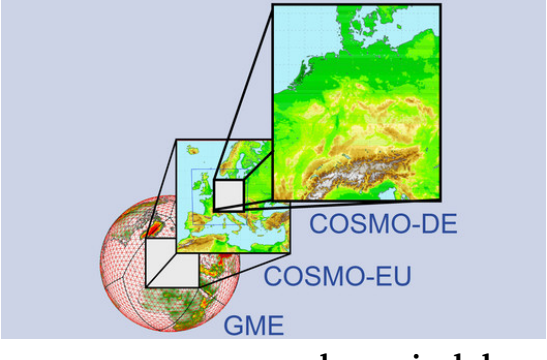
Climate Scenarios: global (1° warming level)

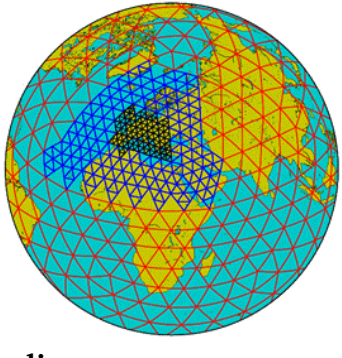


IPCC, 2013

Climate Scenarios: downscaling

CMIP5 → Cordex **ICON**

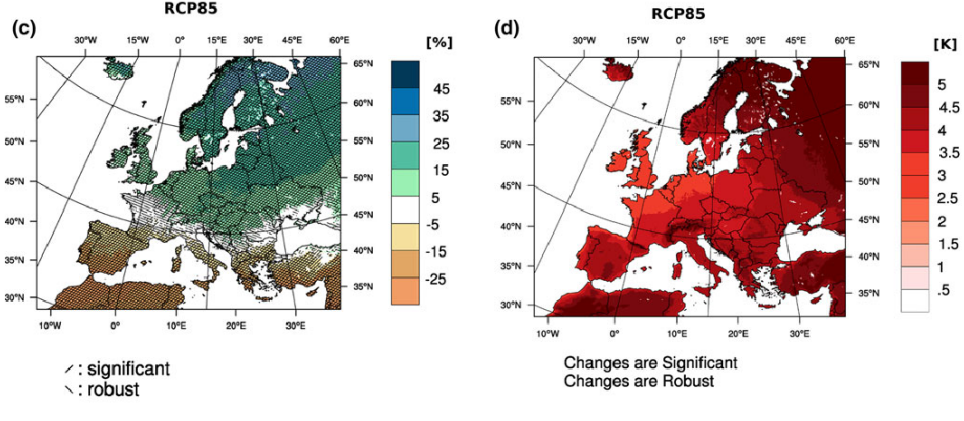




DWD

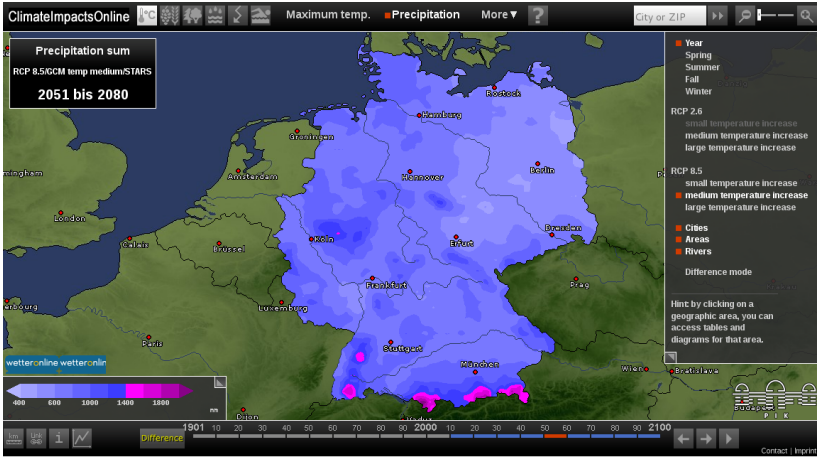
dynamical downscaling

Climate Scenarios: regional



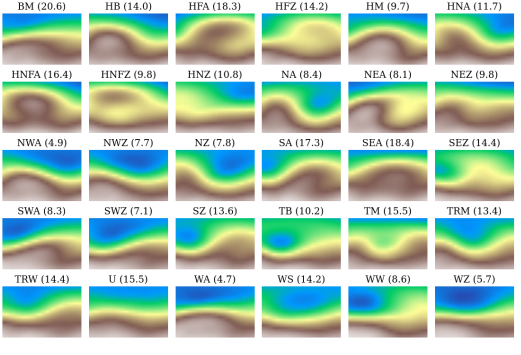
Jacob et al. 2013

Climate Scenarios: national



ClimateImpactsOnline

Weather in Climate Models: Pattern in Reanalyes



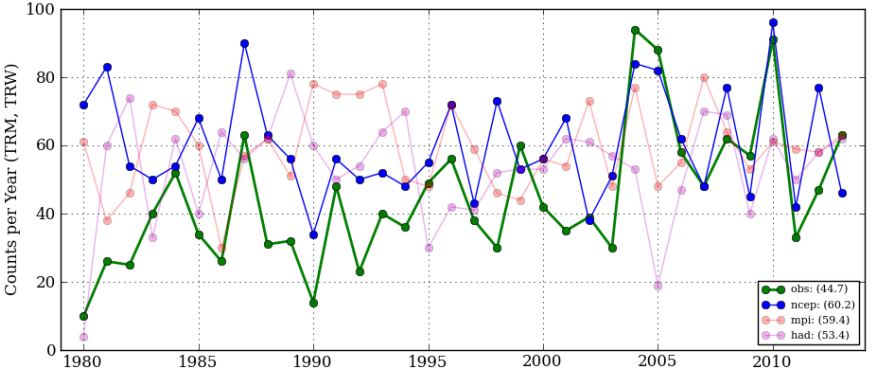
European circulation pattern at GPH500
Climatology

WZ	Cyclonic Westerly
SWA	Anticyclonic South-Westerly
NWZ	Cyclonic North-Westerly
HM	High over Central Europe
BM	Zonal Ridge across Central Europe
TM	Low (Cut-Off) over Central Europe
NA	Anticyclonic Northerly
NZ	Cyclonic Northerly
HB	High over the British Isles
TRM	Trough over Central Europe
SA	Anticyclonic Southerly
SZ	Cyclonic Southerly
TB	Low over the British Isles
TRW	Trough over Western Europe

Weather in Climate Models: long-term Trends

Identification of European circulation pattern via image comparison

"Trough over Europe"

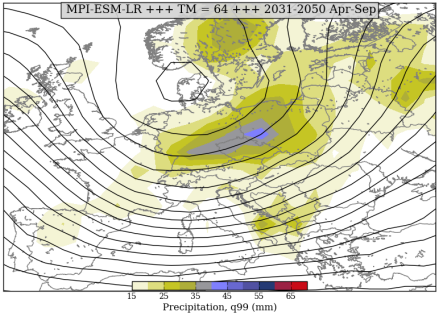


observation/reanalyses	⇑	climate models	⇔

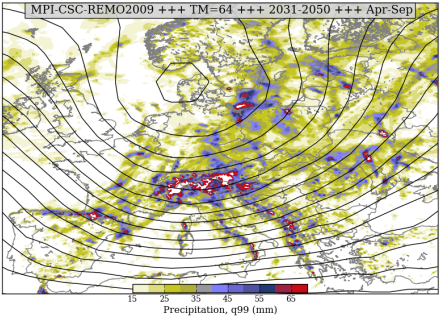
Weather in Climate Models: Applications

Low over Central Europe (TM)

GCM



RCM

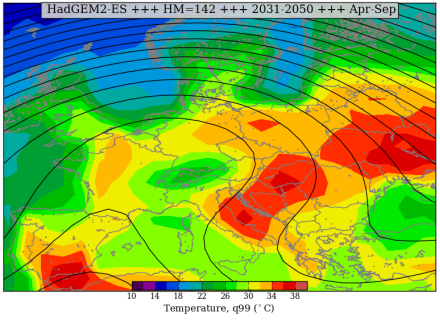


heavy precipitation

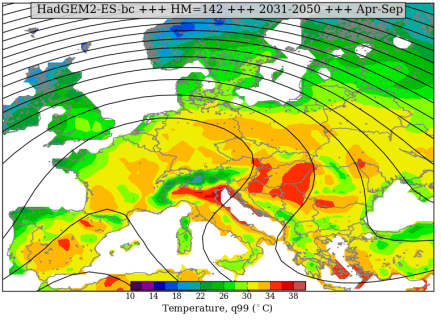
Weather in Climate Models: Applications

High over Central Europe (HM)

GCM uncorrected



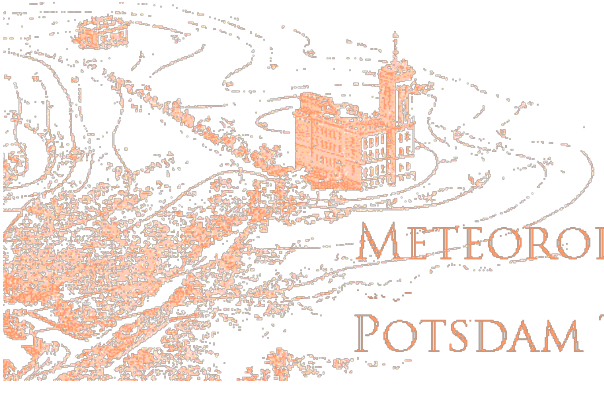
GCM corrected



temperature extreme

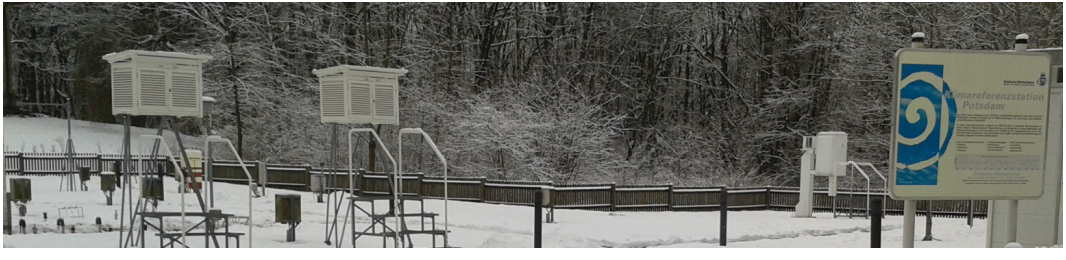
PIK

Invitation to visit



Long-Term Meteorological Station Potsdam Telegrafenberg

PIK



- 100 year wihout gaps (81m)
- unchanged measurement and boundary conditions
- recording of the most important meteorol. values
- jewel among the meteorol. long-term series worldwide
- first official weather observation: 1st Jan 1893
- Reinhard Süring: director from 1909 for 23+5 years
- record ballon ascend: 31st July 1901 (10.800m)
- Süring died in the age of 85 years (1951)
- 2020: DWD plans to say goodbye from visual observ.

The long-term station Potsdam is the only one worldwide measuring before 1900:

- soil temperature + snow cover + frost depth + Tmin near ground + cloud forms + sight + precip. kind

Measurement Programme:

- soil temperature: 2cm, 5cm, 10cm, 20cm, 50cm, 1m, 2m, 4m, 6m, 12m